

**This Page Is Inserted by IFW Operations
and is not a part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problems Mailbox.**

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :

A61B 3/135, G02B 17/02

A1

(11) International Publication Number:

WO 91/15150

(43) International Publication Date:

17 October 1991 (17.10.91)

(21) International Application Number: PCT/BE91/00025

(22) International Filing Date: 28 March 1991 (28.03.91)

(30) Priority data:

9000353

29 March 1990 (29.03.90)

BE

(71) Applicant (for all designated States except US): K.U. LEUVEN RESEARCH & DEVELOPMENT [BE/BE]; Groot-Begijnhof, Benedenstraat 59, B-3000 Leuven (BE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): MISSOTTEN, Luc [BE/BE]; Leo Dartelaan 12, B-3001 Leuven-Heverlee (BE).

(74) Agent: BRUIN, Cornelis, Willem; Octrooibureau Arnold & Siedsma BVBA, 21A Hamoiriaan, B-1180 Brussels (BE).

(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.

Published

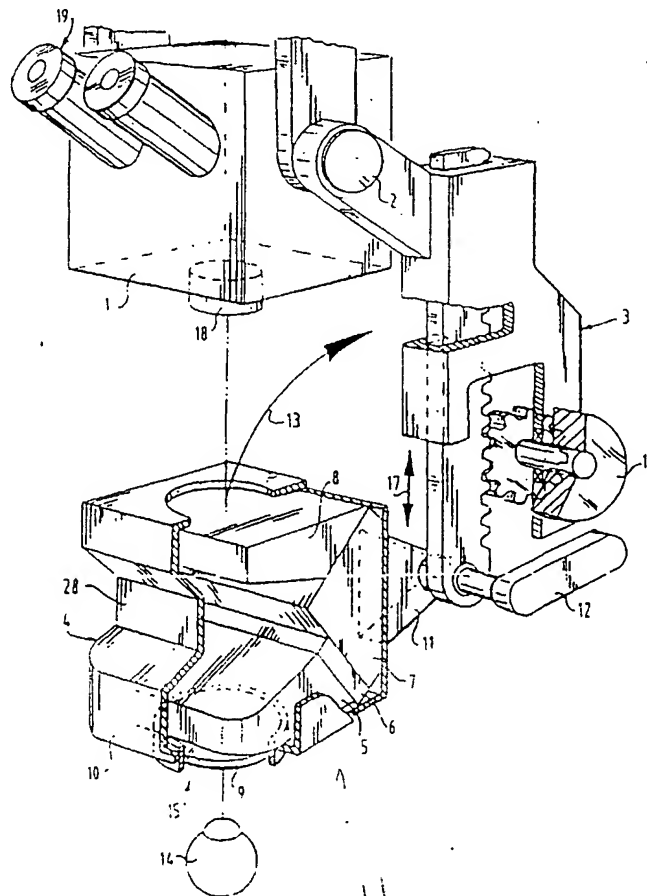
With international search report.

In English translation (filed in Dutch).

(54) Title: DEVICE FOR OBSERVING THE EYE COMPRISING MEANS FOR INVERTING THE IMAGE

(57) Abstract

A device for observing the eye and the eye fundus, comprising a microscope (1), one or more means (5-8) for inverting the image, and a lens (9). The means for inverting the image are placed directly behind the side of the lens that is directed to the microscope, through which both the image of the eye and the external world are visible upright. The construction length of the inversion means is chosen such that the eye surface and the eye fundus can be observed at the same time without a considerable change in the focussing of the microscope.



C L A I M S

1. Device for observing the eye, and the eye fundus, comprising a microscope, one or more means for inverting the image, and a lens, characterized in that the inversion means are placed directly behind the side of the lens that is
5 directed to the microscope.

2. Device according to claim 1, characterized in that the inversion means and the lens are comprised together in a house.

3. Device according to claim 2, characterized in
10 that the house is mounted to the microscope by means of a suspension bracket.

4. Device according to claim 3, characterized in that the suspension bracket is provided with a focussing knob, for focussing the image of the eye.

15 5. Device according to claims 3 or 4, characterized in that the house is mounted pivotably to the suspension bracket for swinging away the inversion means and the lens from the optical axis.

6. Device according to one of the foregoing claims,
20 characterized by a slitlamp, the light of which falls through the inversion means and the lens from the side directed to the microscope.

7. Device according to one of the foregoing claims, characterized in that the inversion means comprise two
25 Baureenfeind reflection prisms of 45° and a reflection prism of 90° with rooftop surfaces.

8. Device according to one of the foregoing claims, characterized in that the lens is a lens of +90 dioptre.

9. Device according to one of the foregoing claims,
30 characterized in that

$$L = O - (2 \times f)$$

accounts for the dimensions L of the inversion means, wherein f is the focal distance of the ophtalmoscope lens, and O the optical path of the inversion means, wherein the glass
35 path is converted to air path, taking the refractive index of glass into consideration.

DEVICE FOR OBSERVING THE EYE COMPRISING
MEANS FOR INVERTING THE IMAGE

The invention relates to a device for observing the eye and the eye fundus, comprising a microscope, one or more means for inverting the image, and a lens.

For surgery on or in the eye it is of importance
5 that the surgeon has an image of the eye that is as true-to-nature as possible. When the usual operating microscopes are used in combination with the so-called opthalmoscope lens, this convex lens will cause an inversion of the image which negatively affects the eye-hand coordination of the surgeon.
10 In the Canadian patent 974103 an inversion system is described wherein a tubular house comprises on one end of the tube the opthalmoscope lens and on the other end of the tube a prisma system. The prisma system causes an inversion of the image. A drawback of this inversion system is that
15 the surgeon sees through the tubular house only the inside of the eye and does not see the eye surface and the external world. When the house is left out the external world is yet visible but inverted. In order to permit the surgeon to use both hands the tube in combination with the binocular micro-
20 scope can be arranged on the head of the surgeon. Such a construction is not very practical.

The invention has for its object to provide an inversion system that avoids the above drawbacks.

This is achieved by the invention by placing the
25 inversion means directly behind the side of the lens that is directed to the microscope. When the inversion means are placed directly in front of the microscope, as in the inversion system of the Canadian patent 974103, the complete image observed through the microscope is inverted. The image
30 of the eye that was already inverted is now upright, while the external world, which was originally upright, is now inverted. By placing the inversion means directly behind the lens only the already inverted image falling through the

lens is inverted back so that this will be upright. Nothing changes in the external world.

For an easy manageableness of the inversion system the inversion means and the lens can be arranged together in
5 a house. This house is preferably mounted to the microscope by means of a suspension bracket.

The eye fundus and the eye surface can be observed at the same time without considerable change in the focal adjustment of the microscope when for the dimension L (the
10 construction length) of the inversion means applies:

$$L = O - (2 \times f)$$

applies, wherein f is the focal distance of the ophtalmoscopic lens, and O is the optical path for the inversion means, wherein the glass path was converted to air path, taking
15 into consideration the refractive index of glass.

In a preferred embodiment of the invention the suspension bracket is provided with a focussing knob for focalizing the eye fundus image. This is necessary when the inside of near-sighted or far-sighted eyes is observed.

20 In another embodiment of the device according to the invention one of the prisms of the inversion means is so moveable that the optical path O through the inversion means can be changed without changing the construction length L , so as to allow the eye fundus of near-sighted or far-sighted
25 eyes to be seen into focus without changing the focussing of the microscope with respect to the eye surface.

When a surgeon wants to see the complete eye surface the house can easily be swung away because the house is pivotably mounted to the suspension bracket. This pivotability ensures further the immediate swinging away of the
30 house upon touching the eye. Through this, damage to the eye is prevented.

The device can comprise a slitlamp, the light of which reaches the eye through the inversion means and the
35 lens from the side that is directed to the microscope. When the use of a slitlamp is not possible a lightcable is brought into the eye. The advantage of a slitlamp however,

is that both hands of the surgeon are free to perform surgical manoeuvres.

In a preferred embodiment of the invention the inversion means comprise two Bauerenfeind reflection prisms of 45° and a reflection prisma of 90° with rooftop surfaces and is the lens a lens of +90 dioptre.

The devices comprise further a notch for the fingertips of the surgeon holding the instruments for the operation in the eye.

10 Further details and particulars will become clear from the drawings, wherein:

fig. 1 is a schematic reproduction of the device, wherein the construction length of the inversion means L and the optical path of the inversion means O are indicated;


15 fig. 2 is a partially broken away perspective view of an embodiment of the invention; and

fig. 3 is a partially broken away side view of another embodiment of the invention.

Fig. 1 represents a schematic representation of the device according to the invention, wherein the construction length L of the inversion means and the optical path O through the inversion means are indicated. When both lie to each other as:

$$L = O - (2 \times f),$$

25 wherein f is the focal distance of the ophthalmoscope lens, both the eye fundus and the eye surface can be observed at the same time without considerable change in the focussing of the microscope.

Fig. 2 shows a simple embodiment of the invention. An inversion system 4 is mounted to a microscope at a mounting point 2 by means of a suspension bracket 3. The inversion system 4 comprises inversion means, especially prisma's, 5, 7 and 8, one planparallel plate 6 and a lens 9, together mounted in a house 10. 

35 The inversion system 4 is pivotably mounted with the suspension bracket 3 by means of a mounting element 11. By means of a handle 12 the inversion system 4 can easily be swung away in the direction of the arrow 13. The mounting

element 11 is so smoothly pivotably connected with the suspension bracket that contact of the eye 14 with the bottom side 15 of the inversion system 4 causes a immediate swinging away of the inversion system 4 in the direction of 5 the arrow 13.

The suspension bracket 3 comprises a focussing knob 16 for moving the inversion system 4 in vertical direction according to arrow 17. The image of the eye that reaches the objective 18 via the inversion system 4 is observed by the 10 oculars 19. The house comprises a notch 28 for the fingertips of the surgeon, so as to allow more freedom of movement.

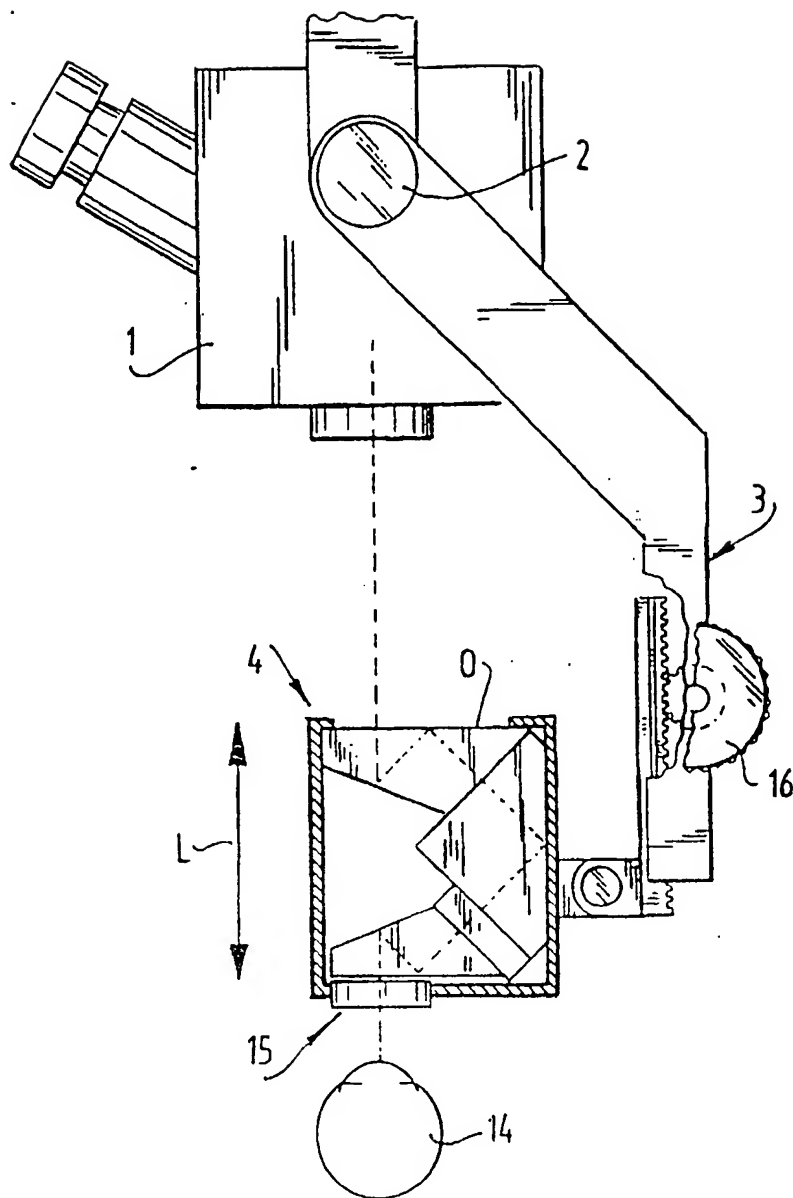
Fig. 3 shows a second embodiment of the invention. An inversion system 23 is mounted to an attachment point 20 15 on the microscope 21 through a suspension bracket 22. The inversion system 23 is pivotable around point 24 in the direction of the arrow 25. The inversion system comprises a house 26 in which inversion means, especially prisma's 27, 29 and 30 and a lens 31 are comprised. Prisma 29 is moveable 20 by means of a cockwheel mechanism 32 in the direction of the arrow 33. A movement according to arrow 33 causes an enlargement or reduction of the optical path O (see also fig. 1). This adaptation allows that even in the case of a not-emmetropie, i.e. near-sighted or far-sighted eyes, the focussing 25 of the microscope can remain the same in the observation of the outside as well as the eye fundus of the eye 35.

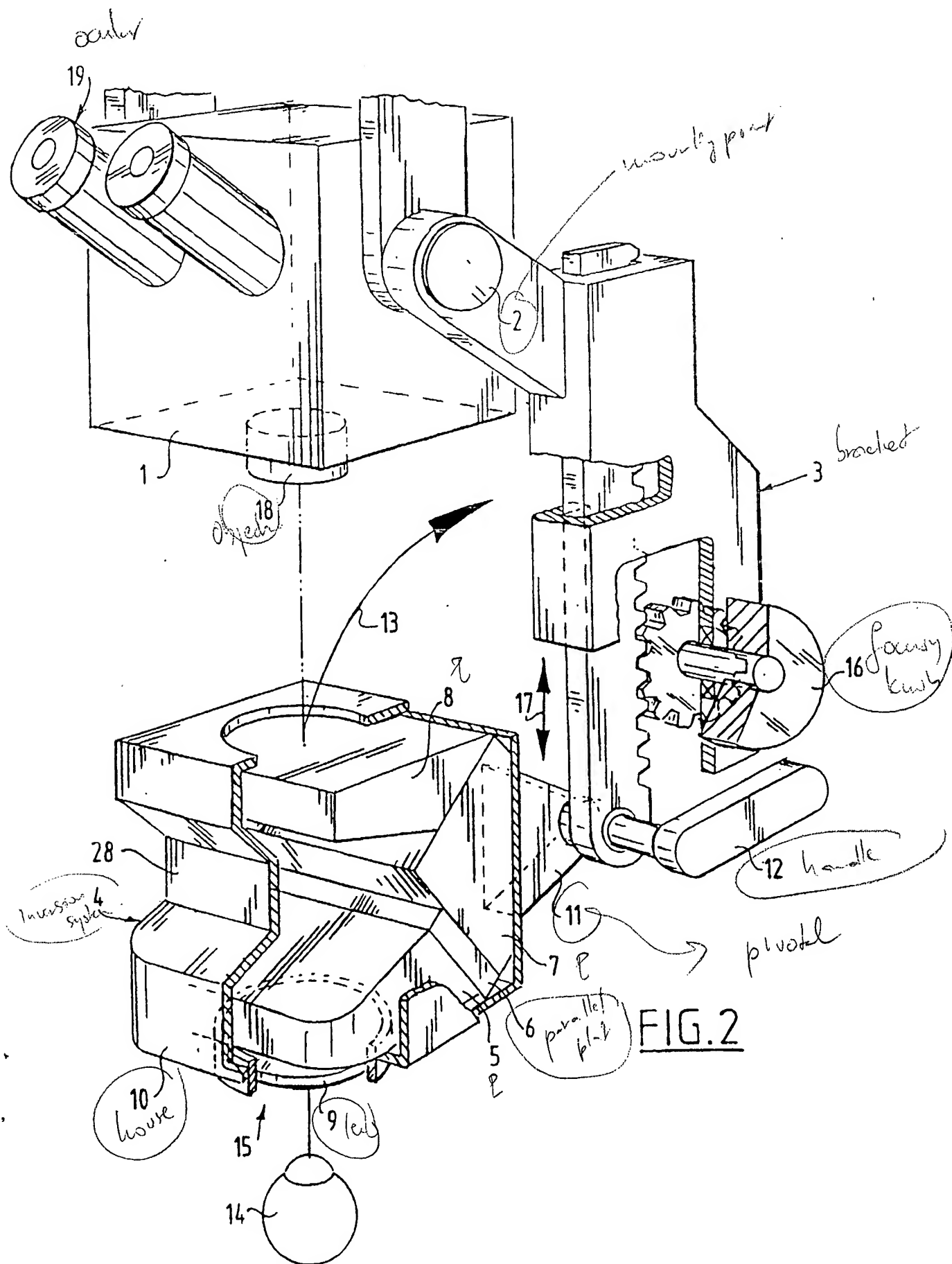
In the vicinity of the microscope 1 a so called slitlamp 34 can be arranged. The parallel slitshaped light beam from the lamp reaches the eye 35 through the inversion 30 system 23.

10. Device according to one of the foregoing claims, characterized in that one prisma of the inversion means is so moveable that the optical path O can be changed without changing the construction length L .

5 11. House with comprised therein a lens and inversion means for use in the device according to one of the foregoing claims.

1/3

FIG. 1



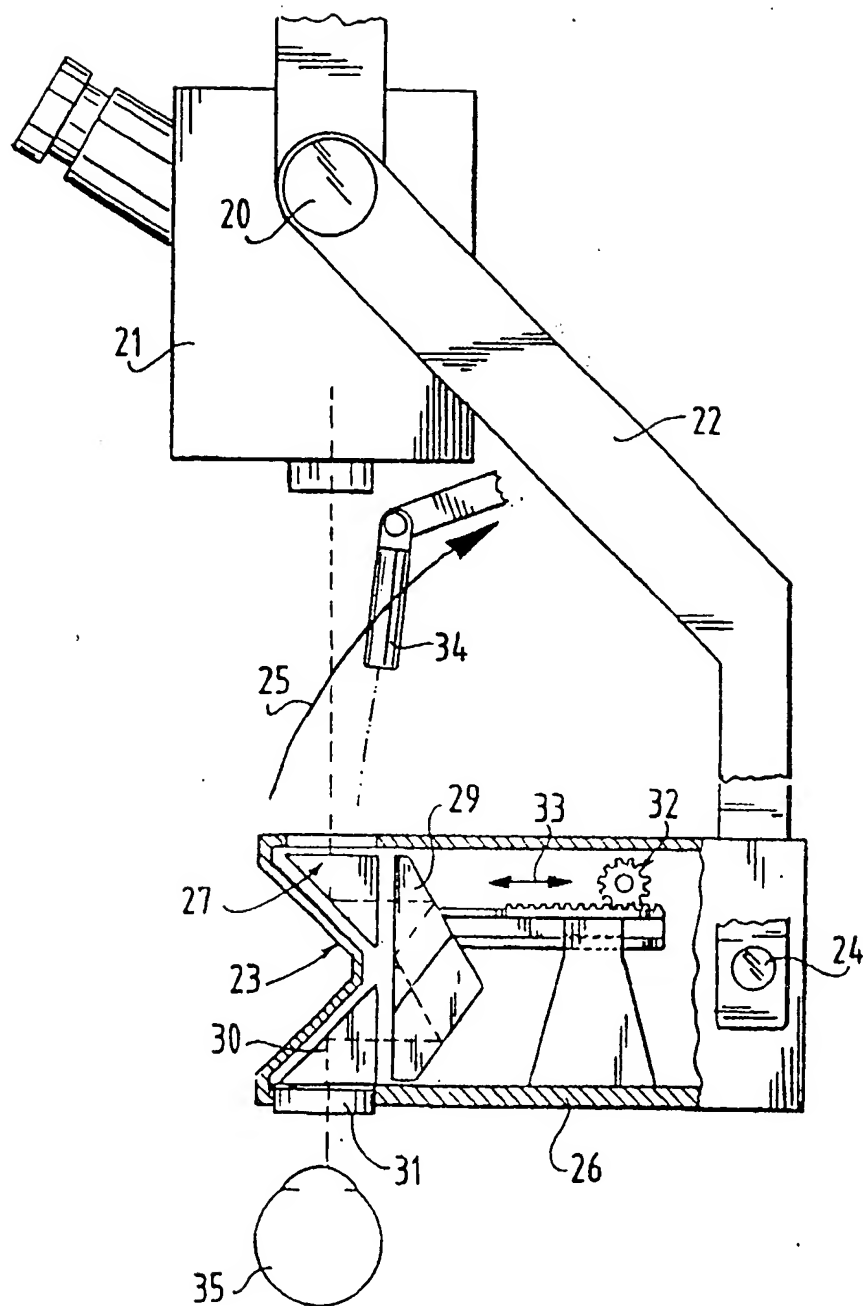


FIG. 3

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)*

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A61B3/135 ; G02B17/02

II. FIELDS SEARCHEDMinimum Documentation Searched⁷

Classification System

Classification Symbols

Int.Cl. 5

A61B ; G02B

Documentation Searched other than Minimum Documentation
to the extent that such Documents are Included in the Fields Searched⁸**III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹**

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	DE,A,3615842 (J.D. MÖLLER OPTISCHE WERKE G.M.B.H.) 12 November 1987 see column 2, line 38 - column 4, line 4 see figures	1, 7, 10
Y	FR,A,2216971 (OPTISCHE WERKE G. RODENSTOCK K.G.) 06 September 1974 see page 1, lines 16 - 36; figures	1
A	see page 2, line 7 - page 3, line 28	3, 5, 6
Y	DE,B,1011638 (E. LEITZ G.M.B.H.) 04 July 1957 see column 1, line 37 - column 3, line 14	1
A	see figure	2, 4, 7, 10

* Special categories of cited documents : ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the International filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

20 JUNE 1991

Date of Mailing of this International Search Report

10. 07. 91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

RIEB K.D.

